REDESCRIPTION OF *LOLLIGUNCULA BREVIS* (BLAINVILLE) (MYOPSIDA, LOLIGINIDAE) FROM SOUTHEASTERN BRAZIL

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ABSTRACT

A detailed description of the loliginid *Lolliguncula brevis* (Blainville, 1823) is given, based on material from the probable type locality, the southeastern Brazilian coast. Several morphological differences with the northern hemisphere supposed co-specific specimens are commented.

KEYWORDS. *Lolliguncula brevis*, Loliginidae, Cephalopoda, morphology, Brazil.

INTRODUCTION

Lolliguncula brevis (Blainville, 1823), type species of a genus with five valid species (BRAKONIECKI, 1980), has been reported from New Jersey (USA) to Patagonia (Argentina) (VOSS, 1956; ROPER, 1978; ROPER **et al.**, 1984; HAIMOVICI & PEREZ, 1991). This species, being commercially interesting in northern waters, has been aim of numerous papers in several branches of the Biology, e.g., in last 10 years 26 papers directly on *L. brevis* were published. In contrast, the morphologic knowledge on *L. brevis* is restrict to an outer view, and schematic pictures of hectocotylus and suckers (VOSS, 1956; ABBOTT, 1974; ROPER, 1978; ROPER **et al.**, 1984), these based on specimens from north regions of the species' distribution. The type locality of *L. brevis* is "Brazil, probably near

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Rio de Janeiro" (VOSS, 1956). Specimens from southeastern Brazilian coast, the probable type locality, are numerous in the Museu de Zoologia, Universidade de São Paulo (PEREZ & HAIMOVICI, 1991). Comparing these specimens with the data of the formely cited papers, some interesting differences appear.

This paper brings detailed description of specimens from the probable type locality, as base for a future comparative study of foreign specimens. For moment the discussion is restricted to comparisons with published data, showing the differences which may be explored in future.

Species of the genus *Lolliguncula* Steenstrup, 1881, differ from species of the other loliginid genera in having rounded fins and a spermatophore-pad near left gill (STEENSTRUP, 1887; BRAKONIECKI, 1980), also in being collected sometimes in estuarine environment (BRAKONIECKI, 1980).

MATERIAL AND METHODS

The examined specimens of *L. brevis* come from the collection of the Museu de Zoologia, Universidade de São Paulo (MZSP), collected from Rio de Janeiro to Santa Catarina coast. Some specimens were fixed in 4% formalin, most part in 70% ethanol.

The measurements (in mm) and indices are as defined by VOSS (1963), the analyzed data are based on 30 males and 30 females of the following lots: MZSP 27057 (2♂, 5♀); 27068 (5♀); 27071 (1 ♀); 27052 (1 ♀); 16111 (1 ♂); 27054 (1 ♀); 27971 (2 ♀); 27164 (23 ♂, 5 ♀), 27992(4 ♂), 27993 (10 ♀). Abbreviations: I ,II ,III, IV: arm index respectively of dorsal, dorsolateral, ventrolateral and ventral arms; ASI, arm sucker index; CLI, club length index; FLI, fin length index; FWI, fin width index; GWI, gladius length index; HcLI, hectocotylus length index; HWI, head width index; ML, mantle length; MWI, mantle width index; TLI, tentacle length index; TSI, tentacle sucker index.

Sixty specimens were dissected by normal technique, immersed in 70% ethanol. All drawings were made using a camera lucida. Radulae were examined on slides with Hoyer. Suckers were examined **in situ** or removed, dehydrated in ethanol series, stained with carmine, cleared and fixed in creosote. Some isolated chitinous sucker rings and spermatophores were examined by this same technique. Systematics and anatomical terminology were based on BRAKONIECKI (1984) and ROPER **et al.** (1984). The synonymyc list only presents studies on South American specimens.

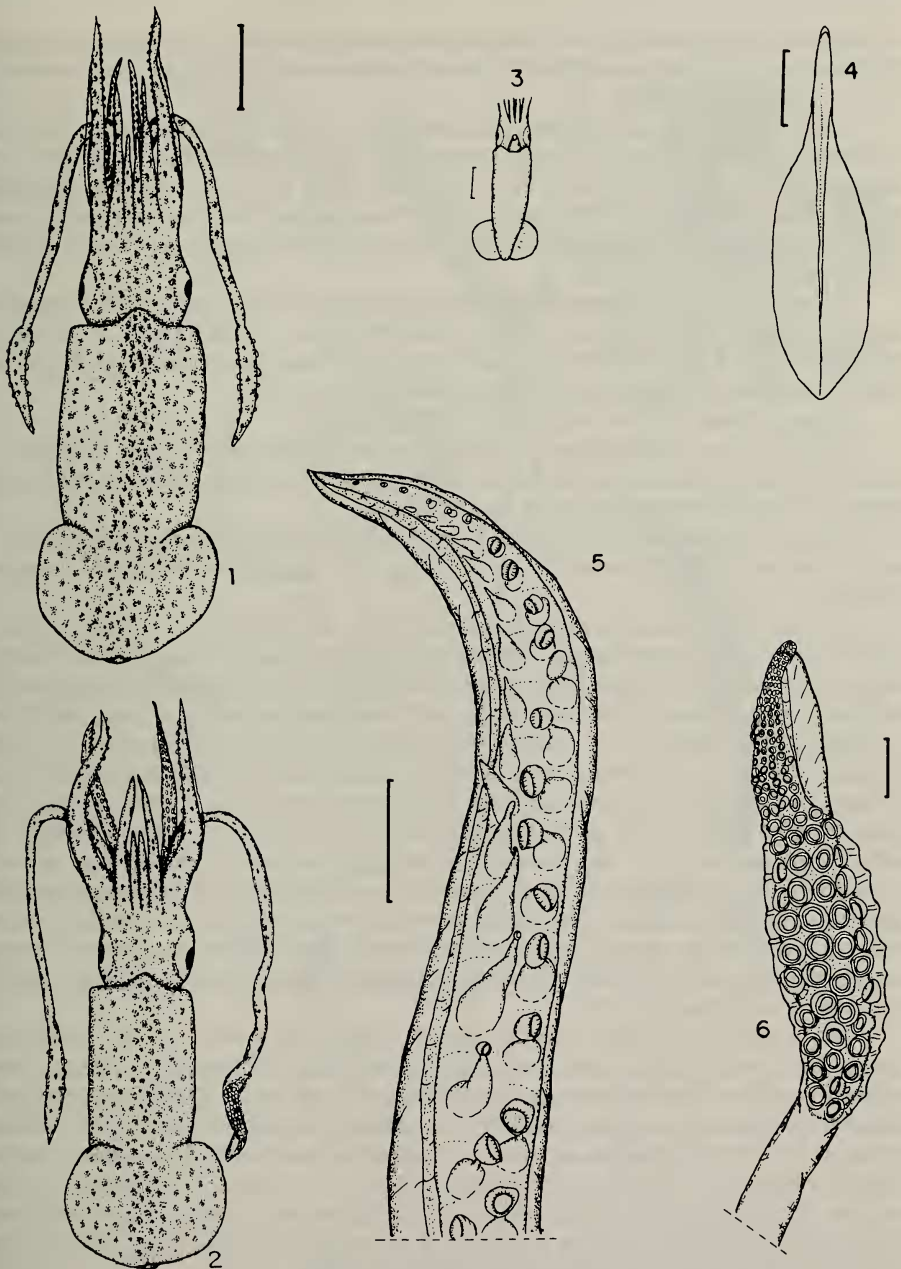
Lolliguncula brevis (Blainville, 1823)

(Figs. 1 - 21)

Loligo brevis BLAIVILLE, 1823: 133 [holotype (from Brazil): Muséum National d'Histoire Naturelle, Paris (not examined)].

Lolliguncula brevis: STEENSTRUP, 1881: 242; 1887: 202-203; VOSS, 1956: 110-113, figs. 5a - c (part) [referred type locality as probably near Rio de Janeiro]; RIOS, 1975: 268, pl. 89, fig. 1297; BRAKONIECKI, 1980: 429 (key); 1984: 435; Haimovici **in** RIOS, 1985: 284, pl.100, fig. 1400; 1994: 312, pl.108, fig. 1531; HAIMOVICI **et al.**, 1989: 509; PEREZ & HAIMOVICI, 1991: 255; HAIMOVICI & PEREZ, 1991: 222.

Diagnosis. Small sized, rounded fins with about 1/3 of mantle length, posterior end of mantle extends farther than fins insertion; gladius wide, rounded or somewhat angulose in its posterior end. Marginal suckers of tentacular club with about same size as central suckers. Buccal membrane with suckers. Rachidian radular teeth with well developed lateral cusps and slender central cusp, almost



Figs. 1 - 6. *Lolliguncula brevis*: 1, dorsal view of a female; 2, dorsal view of a male; 3, scheme of ventral view of a male; 4, gladius from male; 5, hectocotylized portion of left ventral arm IV; 6, tentacular club from female. Scale lines: 10 mm, figs. 1-4; 1 mm, fig. 5; 2 mm, fig. 6.

rectangular marginal teeth. Left ventral arm hectocotilized, with third distal part of dorsal row of suckers modified by loss of suckers and development of pedicels.

Description. Mantle. Moderately short (ML, ♂ 29.0-*34.5*-41.0 mm, ♀ 30.0-*49.0*-73.0 mm), cylindrical and rounded posteriorly (fig. 3); width about one third of length (MWI, ♂ 29.0-*33.7*-42.9, ♀ 26.7-*33.0*-45.7) (figs. 1, 2); anterior margin wide, slightly flared, and with distinct dorsal lappet margin anterior end of gladius; ventral margin excavated below funnel with pointed angles marking location of mantle funnel locking apparatus (fig. 3).

Fins. Rounded in outline, widest at midpoint and occupy about 40% of mantle length regardless of body size (FLI, ♂ 35.3-*39.2*-43.4, ♀ 34.3-*41.0*-45.7); (FWI, ♂ 43.7-*55.0*-74.2, ♀ 47.3-*57.6*-68.5). A small concavity found at posterior tip. Posterior end of mantle extends discreetly farther than fins insertion.

Head. About half as long as wide (HWI, ♂ 28.4-*32.5*-36.6, ♀ 23.9-*28.1*-34.7).

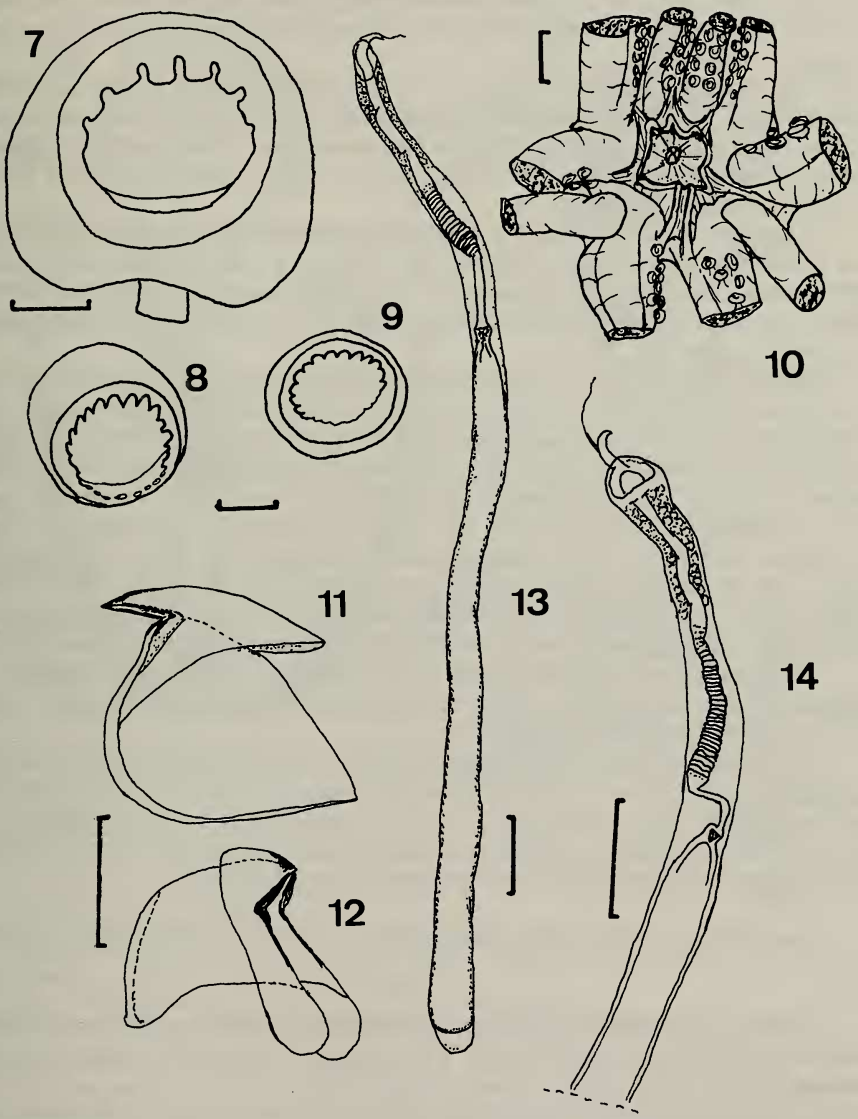
Funnel. Stout and compact, reaching to about middle of eye (fig. 3). Mantle-funnel locking apparatus simple and straight (fig. 15). Dorsal member of the funnel organ "A" shaped with large oval ventral pads.

Buccal membrane. Seven-lobed, with supports attached dorsally on arms I and II and ventrally on arms III and IV (fig. 10). Each lobe with 3 to 5 ringed suckers.

Arms. Of moderate length and in order IV, III, II, I (70.2%) or III, IV, II, I (29.8% of measured specimens). Dorsal and ventral protective membranes border sucker rows on all arms, third pair of arms bordered, in its full length, by a flattened swimming membrane. Arm suckers in two rows and of medium size; dentition with 7 or 8 broad flat teeth on distal half of ring, proximal half smooth (fig. 7), all teeth of similar size. No obvious sexual dimorphism found in either size or dentition of suckers of specimens of similar size. Left ventral arm hectocotylized (fig. 5) in male for less than a third of its length (HcLI, 22.5-*28.3*-33.3), approximately 15 pairs of normal suckers, on distal 1/3 of the arm, suckers of dorsal row greatly reduced in size, and supported by elongated triangular pedicels that become smaller distally, proximal pedicels (one to three) with a very small sucker visible, other pedicels with sucker missing, no developed papilla was found. Suckers of ventral row unmodified, about 14 pair of suckers in modified area, distal two to five suckers of dorsal row lacking (fig. 5).

Tentacles. Tentacular stalks long and compressed, with dorsal keels that expand into swimming membranes at base of clubs (figs. 1, 2); orally, median groove extends to base of clubs where margins diverge to form two swimming membranes. Distinct manus and dactylus present but no distinguishable carpus (fig. 6). About 10 transverse rows of suckers in manus arranged in four longitudinal rows. Manus suckers enlarged, with those of marginal rows 2/3 or more length than median suckers. Chitinous sucker rings regularly spaced, pointed teeth longest on distal half of median suckers and on lateral half of marginal suckers (figs. 8, 9); some variation occurs in relative sizes and number of teeth.

Color. Basic color white, rarely pale reddish. Dark chrommatophores, scattered at full length of mantle, funnel, head, external face of arms and clubs, and dorsal face of fins. When fixed, may become reddish or yellowish.



Figs. 7 - 14. *Lolliguncula brevis*: 7, sucker from right arm III, row seven of same; 8, large tentacular sucker of median row of same; 9, small tentacular sucker of marginal row of same; 10, buccal region of a female, showing buccal membrane, arms and tentacle sectioned; 11, 12, upper and lower beaks from female; 13, spermatophore from male; 14, detail of spermatophore extracted from a female pallial cavity. Scale lines: 0.2 mm, figs. 7-9, 13, 14; 2 mm, figs. 10-12.

Gladius. Moderately short and wide (fig. 4) (GWI, ♂ 25.0-*29.9*-36.7, ♀ 21.1-*27.2*-30.8). Rachis narrow. Edges of vanes slightly curved, with no lateral thickenings or at most broad diffuse ones. Translucent. Rounded to somewhat angulate posterior end.

Digestive system. Beaks (figs. 11, 12) with lower beak moderately short. Radula (fig. 17) bearing rachidian with relatively long marginal cusps and slender central cusp; marginal element somewhat rectangular. Remainder of digestive system as normal loliginid fashion (fig. 15), but short; details of caecum leaflets and gastric typhlossolis in fig. 16.

Respiratory, excretory and circulatory systems. With normal loliginid model, gills with about 40 lamellae. Kidney (fig. 19) with a pair of small and elevated nefrostomes. Ventricle with a posterior (visceral) slender aorta and two anterior vessels, left vessel much more developed (cephalic aorta) and marges oesophagus to anterior region (fig. 18).

Female genital system. Characteristic of family (fig. 21). Ovary occupies most of available space within visceral sac when developed. A slender oviduct runs through digestive caecum base (fig. 16: ov). End portion of oviduct (in left side of visceral sac, just beside of left gill) with a large, bilobed gland, with organization similar of that of main nidimental glands (fig. 21: og). Main nidimental glands much developed, in their usual site (fig. 21); accessory nidimental glands inconspicuous, two rounded, small, glandular masses between anterior region of kidney and main nidimental glands, one on each side (figs. 18, 19). No clear spermatophore-pad visible, some females have about 30 spermatophores (in usual site of other *Lolliguncula* species), below left gill, near oviduct aperture (fig. 21).

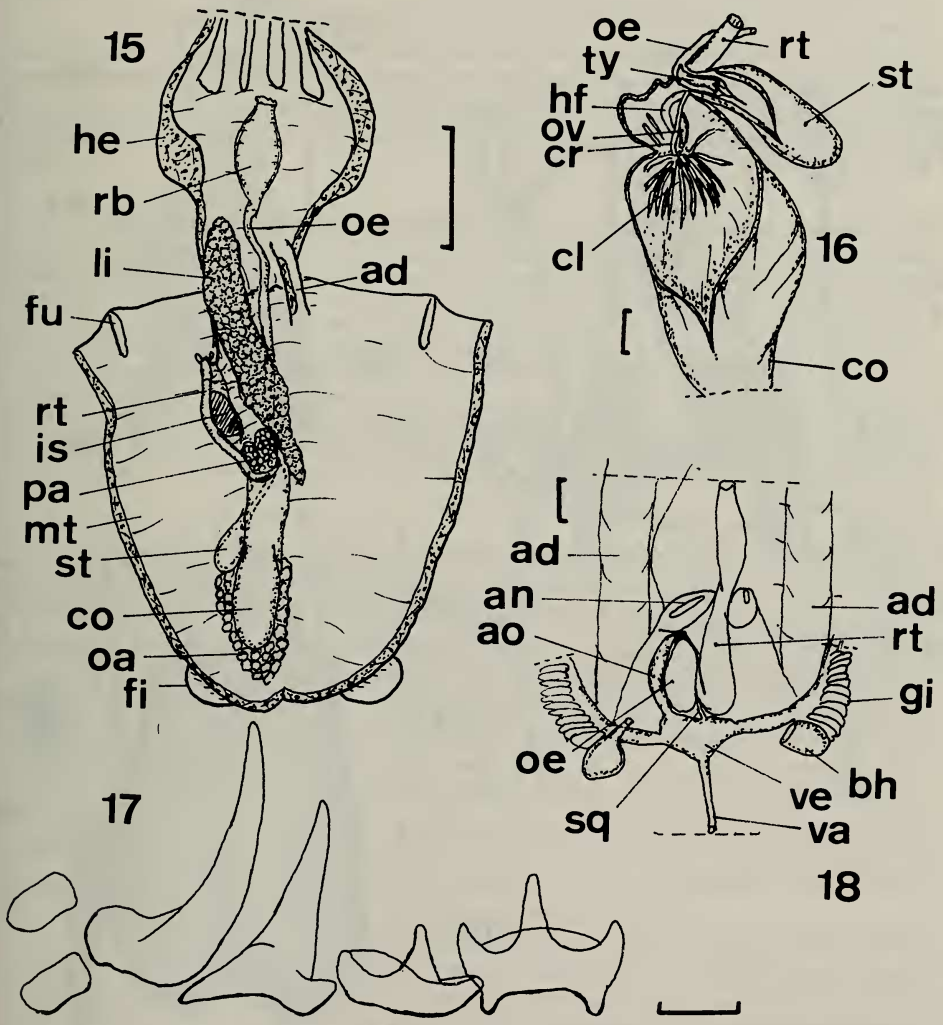
Male genital system. Penis wide, thin walled (fig. 20), seminal vesicle with a slender, central, curved lobe. Spermatophores small and thick (fig. 13), cement body and adjacent structures in fig. 14.

Development. Males smaller than females. In examined specimens, smallest mature male with ML = 29.0 mm, and largest immature male with ML = 29.0 mm. Smallest mature female with ML = 38.0 mm, and largest immature female with ML = 57.0 mm. Largest specimen examined a female (MZSP 27057) with ML = 73.0 mm. Sex-ratio approximately two females for each male.

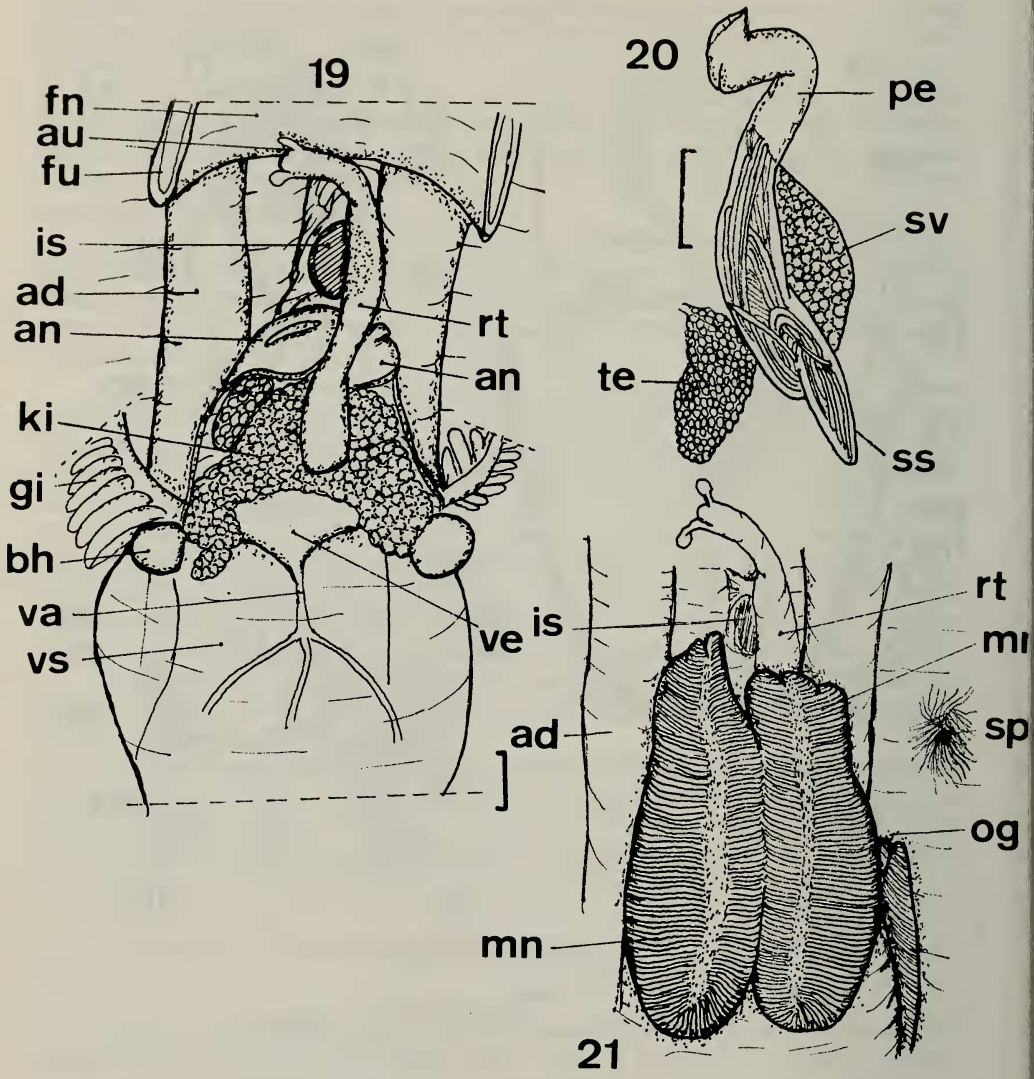
Distribution. In literature from New Jersey in USA to Patagonia in Argentina.

Habitat. The available material was collected in neritic marine environment, shallow waters from 2 to 8m depth. The sediment varies from sandy to muddy bottoms.

Measurements. ML, ♂ 29.0-*34.5*-41.0, ♀ 30.0-*49.0*-73.0; MWI, ♂ 29.0-*33.7*-42.9, ♀ 26.7-*33.0*-45.7; HWI, ♂ 28.4-*32.5*-36.6, ♀ 23.9-*28.1*-34.7; FLI, ♂ 35.3-*39.2*-43.4, ♀ 34.3-*41.0*-45.7; FWI, ♂ 43.7-*55.0*-74.2, ♀ 47.3-*57.6*-68.5; I, ♂ 19.4-*25.6*-34.3, ♀ 16.4-*24.4*-32.6; II, ♂ 30.3-*39.8*-51.6, ♀ 26.0-*35.0*-50.0; III, ♂ 42.1-*52.5*-65.7, ♀ 33.3-*46.2*-63.0; IV, ♂ 50.0-*59.1*-74.3, ♀ 31.3-*46.0*-65.2; HcLI, 22.5-*28.3*-33.3; TLI, ♂ 65.8-*108.3*-165.7,



Figs. 15 - 18. *Lolliguncula brevis*: 15, scheme of digestive system of a female, lateral-left view (head and mantle opened ventrally); 16, detail of median region of digestive system showing caecum and stomach opened longitudinally; 17, radula form; 18, scheme of heart, female specimen, main nidimental gland and kidney removed. (Abbreviations: ad, adductor muscle; an, accessory nidimental gland; ao, anterior aorta; bh, branchial heart; cl, caecum leaflets; co, caecum; cr, caecum ridge; fi, fins; fu, mantle-funnel locking apparatus; gi, gill; is, ink sac; he, head; hf, hepatopanchreatic fold; li, liver; mt, mantle; oa, ovarium; oe, oesophagus; ov, oviduct; pa, panchreas; rb, radular bulb; rt, rectum; sa; secondary anterior aorta; st, stomach; ty, typhlossolis; va, visceral aorta; ve, ventricle.). Scale lines: 10 mm, fig. 15; 2 mm, figs. 16, 18; 0.1 mm, fig. 17.



Figs. 19 - 21. *Lolliguncula brevis*: 19, kidney region, ventral view of a female, main nidimental gland extracted; 20, portion of male genital system, ventral view; 21, detail of fertilized female genital system and mantle cavity, showing position of spermatophores, left gill removed. (Abbreviations: ad, adductor muscle; an, accessory nidimental gland; au, anus; bh, branchial heart; fn, funnel; fu, mantle-funnel locking apparatus; gi, gill; is, ink sac; ki, kidney; mn, main nidimental gland; og, oviduct opening; pe, penis; rt, rectum; sp; spermatophores; ss, spermatophoric sac; sv, seminal vesicle; te, testis; va, visceral aorta; ve, ventricle; vs, visceral sac.) . Scales lines: 2 mm.

♀ 56.0-*111.4*-160.0; CLI, ♂ 24.2-*31.8*-42.9, ♀ 26.7-*35.8*-45.7; ASI, ♂ 1.4-*2.0*-2.8, ♀ 1.1-*1.9*-2.6; TSI, ♂ 1.2-*2.2*-2.5, ♀1.1-*2.2*-3.0; GWI, ♂ 25.0-*29.9*-36.7, ♀ 21.1-*27.2*-30.8.

Remarks. The main studied lot comes from Praia Grande, South coast of São Paulo. *L. brevis*, from this area, presents commercial interest by serving as human food. When several specimens were collected in otter trawl (shrimp collect), what is not frequent, they are sold by fishermen, jointed with the rarer *Loligo sanpaulensis* and *L. plei*. Although these species are preferred by having larger size.

Material examined. BRAZIL. **Rio de Janeiro:** Barra de São João, (MZSP 27053) 1♀, VII.1983; Atafona, (27055) 1♂, 2♀, 8.IV.1964; Ilha Grande, Enseada das Estrelas, (27057) 2♂, 5♀, VII.1966. **São Paulo:** S.Paulo coast, (27082) 1 ♂; Ubatuba, (IOUSP Base), (27068) 5 ♀, 29.V.1964; (Itaguá Beach) (789) 2♀;(27164) 31♂, 42♀, 11.II.1970; (27165) 5♂, 14♀, 23.II.1970; (27166) 4♂, 6♀, III.1970; (27972) 2♀; (27973), 10♂,32♀, I.1977; (Lázaro Beach), (27088) 9♀, 4.VI.1970; (Flamengo Beach) (27054) 1♀, I.1970; São Sebastião (Grande Beach), (15499) 1♀; (Alcatrazes Island) (27052) 1♀, 25.XI.1964; Santos, (Bay, near Moela Island) (791) 1♀; (15543) 2♂, 3♀, 14.VII.1961; (27163) 2♂, 5♀, 30.III.1979; (Farol da Moela) (27074) 1 ♀, VII.1969; (Moela Island) 27971, 2 ♀, 22.V.1962; (Gonzaga Beach) (27071) 1 ♀, 22.I.1970; Praia Grande, (off Boqueirão Beach, 24°01'S 46°36'W, 2 to 8m depth): (27987) 1♂; (27988) 1♀; (27989) 1♂; (27990) 1♀; (27991) 4♂; (27992) 10♀; (27993) 5♂; (27320) 3♀; Cananeia, (27070) 4♀, VII.1974. **Santa Catarina:** Itapema, Itapema Beach, (16111) 1♂, 15.VII.1965.

Discussion. *Lolliguncula brevis* from southeastern coast of Brazil (the probable type locality) differs from *Lolliguncula brevis* **sensu** VOSS (1956); ABBOTT (1974); ROPER (1978) and ROPER **et al.** (1984), from northern waters, by having: 1) small size; 2) thinner walled mantle; 3) mantle rounded posteriorly; 4) mantle cylindrical (not widest in mid portion) even in mature females; 5) posterior end of the mantle extends farther than the fins insertion; 6) white or pale reddish color (the northern specimens are dark reddish brown to brownish yellow according to ROPER, 1978); 7) fins shorter [FLI average = 40.1 in contrast with 53.8 (VOSS, 1956)] and more slender [FWI average = 56.3 in contrast with 83.7 (VOSS, 1956)]; 8) few modified suckers in hectocotylized arm, all these rather similar and without developed papillae; 9) slender arms; 10) presence of suckers in buccal membrane [*L. brevis* from the northern waters lacking these (ROPER **et al.**, 1984:80)]; 11) the habitat, for moment absent in estuaries.

The analysis of those differences can be due to intraspecific or interspecific variations. This question only will be resolved with further research, e.g., on inner morphology of the northern specimens (as spermatophore, radula, beak), and analysis of the morphology of specimens from intermediary geographic regions as, e.g., north Brazilian coast and south Caribbean.

Two data found in *L. brevis* are unusual, if the diagnosis of the family Loliginidae by ROPER **et al.** (1984) is used: the posterior region of the mantle extending farther than the fins insertion, and the accessory nidimental glands very inconspicuous.

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